

fuel pressure difference across the valve member, whereby when the valve member is in the open state fuel from the accumulator volume is able to flow from the accumulator, through a return passage, into the high pressure fuel line for the purpose of administering the late post injection of fuel.

11. A fuel system as claimed in claim 10, wherein the valve member is biased towards a closed state by means of a valve spring housed within a spring chamber.

12. A fuel system as claimed in claim 11, wherein the spring chamber communicates with low pressure.

13. A fuel system as claimed in claim 11, wherein the spring chamber communicates with the accumulator volume.

14. A fuel system as claimed in claim 11, wherein the spring chamber communicates with the high pressure line.

15. A fuel system as claimed in claim 9, wherein the additional valve arrangement further includes at least a first non-return valve, arranged in a primary supply passage, for controlling the flow of high pressure fuel from the high pressure supply line to the accumulator volume.

16. A fuel system as claimed in claim 1, wherein the injection control valve arrangement and the additional valve arrangement are arranged to provide the primary injection event at a primary fuel injection rate, and the secondary injection event at a secondary fuel injection rate which is greater than the primary fuel injection rate.

17. A method of delivering fuel to an internal combustion engine provided with an after treatment device for reducing emission levels, the method comprising;

driving a pumping plunger to perform a pumping stroke of a pumping cycle, thereby to pressurise fuel within the pumping chamber to a high level, following which the pumping plunger performs a return stroke of the pumping cycle;

delivering high pressure fuel to an injector associated with the engine through a high pressure line;

controlling an injection control valve arrangement to move between an open state to commence a main fuel injection event and a closed state to terminate the main fuel injection event, during which main fuel injection event a main fuel injection quantity is delivered to the engine; and

moving the injection control valve arrangement from the closed state to the open state to permit a late post fuel injection quantity to be delivered to the engine, within the pumping cycle and a period of time after the main fuel injection event, for the purpose of regeneration of the after treatment device.

18. A method as claimed in claim 17, whereby the late post injection quantity is delivered after completion of the pumping stroke.

19. A method as claimed in claim 18, whereby the late post injection quantity is delivered during a top dwell period between the pumping stroke and the return stroke of the plunger.

20. A method as claimed in claim 17, including providing a sequence of around 3 to 5 consecutive main fuel injection events, each of which is accompanied by a late post fuel injection event.

21. A method as claimed in claim 20, whereby said sequence is provided once for each tank of fuel used by the engine.

22. A method as claimed in claim 17, including providing a periodic distribution of late post injection events between main fuel injection events.

23. A fuel system for use in an internal combustion engine, the fuel system comprising;

a fuel pump having a pumping cycle during which fuel is pressurised to a high level within a pumping chamber for delivery to an injector, whereby the injector is arranged to provide a main fuel injection event and a post fuel injection event, during within the same pumping cycle;

the injector including a valve needle which is engageable with a valve needle seating to control said fuel delivery and an injection control valve arrangement for controlling movement of the valve needle so as to control the main and post fuel injection events; and,

the fuel system further comprising an accumulator volume for storing high pressure fuel for delivering the post fuel injection quantity, and an additional valve arrangement actuatable to control the supply of fuel stored within the accumulator volume to the injector for the post injection event, wherein the additional valve arrangement and the injection control valve arrangement share a common actuator.

24. A fuel system for use in an internal combustion engine, the fuel system comprising;

a fuel pump having a pumping cycle during which fuel is pressurised to a high level within a pumping chamber for delivery to an injector, whereby the injector is arranged to provide a main fuel injection event and a post fuel injection event, during within the same pumping cycle;

the injector including a valve needle which is engageable with a valve needle seating to control said fuel delivery and an injection control valve arrangement for controlling movement of the valve needle so as to control the main and post fuel injection events;

the fuel system further comprising an accumulator volume for storing high pressure fuel for delivering the post fuel injection quantity, and an hydraulically operable valve arrangement for controlling the supply of fuel stored within the accumulator volume to the injector for the post injection event.

* * * * *